

RESEARCH ARTICLE

From Disruption to Regulated Convergence: EU Regulatory Frameworks for FinTech and Digital Financial Services

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Abstract

The growth of Financial Technology (FinTech) has created opportunities for innovation and growth in digital financial services across the European union, driven by greater interaction between technological innovation and financial regulations. This article reviews the emergence of various EU regulatory initiatives that have transformed the FinTech industry from a disruptive innovation into an established, compliant financial infrastructure. The study employed a qualitative, interdisciplinary approach combining doctrinal legal analysis, comparative regulatory evaluation and techno-economic analysis. Beyond reviewing individual regulatory instruments, the research develops a conceptual framework of regulated convergence to analyse how emerging EU regulatory initiatives collectively reshape the governance architecture of digital financial services. It analysed the various major EU regulatory initiatives that have strategic implications (including the PSD3, PSR, IPR, FiDA, DORA, AI act, MiCA and CCD2); findings indicate that the EU is working to build an integrated governance framework for digital financial services based upon interoperability, operational resilience, consumer protection and technology-based accountability. In parallel, the evolution of embedded finance, open finance ecosystems, artificial intelligence, tokenisation and Regulatory Technology (RegTech) has changed the way financial services operate by leveraging data and providing platforms for conducting business. The primary trend in European FinTech is shifting from disruptive decentralisation to regulated convergence between technological innovation, institutional governance and traditional financial institutions.

Key Words: *Financial technology; Payment services; Financial data; Artificial intelligence; Markets in crypto-assets; Consumer credit; EU law; Regulated convergence*

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1. Introduction

The emergence of Financial Technology (FinTech) has fundamentally transformed the organisation of digital financial services, including payment systems, intermediation, data governance and the relationship between technology-based innovations and the regulation of finance within the European union. To understand the structural transformation of the FinTech sector, an interdisciplinary theoretical framework can be constructed which incorporates lifecycle theory, institutional economics, platform economy theory, regulatory governance and Coase's transaction cost economics. By comparing the development of FinTech to three distinct "innovation cycles," it can be seen that the sector has moved from a predominantly disruptive, venture capital-driven phase to a more institutionalised, compliance-oriented phase. From this viewpoint, regulation serves as an increasingly stabilising institutional infrastructure and does not restrict a particular legal mechanism alone, but also affects the structure of markets, their operational resilience and their interoperability across institutions. At the same time, the space for digital finance is evolving from an environment that was highly fragmented or partially decentralised to one characterised by more regulated and integrated ecosystems, i.e., with respect to open finance, embedded finance, AI based compliance and the techno-institutional convergence of traditional and FinTech businesses. Overall, this study concludes that EU regulatory measures applied to FinTech do not only serve to regulate technology-based innovations, but also seek to create a common regulatory foundation for FinTech companies as they transition to functioning as part of the European union's regulated network of financial infrastructure.

1.1. Lifecycle interpretation and macro dimensions

The lifecycle framework can be used to assess how the FinTech sector has evolved from an innovation-driven expansion phase to a more mature, institutionally integrated stage. During the period from 2015-2021, the FinTech markets were dominated by an overall growth-at-all-costs strategy, supported by a relatively abundant Venture Capital (VC) funding, low interest rates and permissive regulation [1]. Competitive advantages were primarily associated with rapid scaling and customer acquisition, rather than with long-term profitability or sustainable operations. The period 2023-2026 of European FinTech ecosystem has been characterised by a post-innovation consolidation phase [2,3]. The tightening of monetary conditions, diminished access to capital for speculation and increased regulatory pressure have shifted the strategic focus of many FinTech firms toward profitability, resilience and compliance. This shift has driven increases in Mergers and Acquisitions (M&A), strategic partnerships with established financial institutions and other forms of institutional integration. FinTech companies have rapidly embraced "co-opetition" strategies, competing and collaborating with traditional banks in interconnected financial environments (Table 1).

Table 1: *Heuristic transformation model of FinTech sector evolution.*

Phase	2015-2021	2023-2026
Capital logic	VC expansion	Profitability
Regulation	Reactive	Proactive
Innovation	Disruptive	Institutional
Competition	Standalone FinTech	Ecosystem integration
Blockchain	Speculative crypto	Regulated tokenisation
Compliance	Cost center	Strategic infrastructure

Source: *Own compilation of the author based on BIS, EBA, ECB, and IMF reports and resources.*

The financial technology industry is undergoing a significant structural change as integrated financial services are increasingly embedded in non-financial digital ecosystems through the Banking-as-a-Service (BaaS) business model. By 2030, the embedded finance market is projected to reach \$7.2 trillion, according to world economic forum projections [4]. Payments, lending, insurance and digital wallets are becoming "invisible" infrastructure, directly integrated into e-commerce, mobility, Software-as-a-Service (SaaS), checkout financing such as Buy Now, Pay Later (BNPL), and other platform environments. A major element of this change involves the larger platform economy & Coasean shift whereby decreasing transaction costs make it easier for companies to integrate financial services into their own operations [5]. The evolution from open banking, through neobanks, to open finance is providing expanded interoperability & access for all levels of investors beyond simply having a payment account, to having access to other (investment) types of assets with firms using financial data as an asset to gain a competitive advantage. At the same time, beyond the existing hype around cryptocurrencies, digital assets and blockchain technologies are being integrated into institutions beyond a purely speculative stage. As such, the industry is evolving from crypto-centric innovation models to regulated models based on tokenising existing assets and stablecoins for settlement and on industrial Decentralised Finance (DeFi), with central banks creating a digital currency [6,7]. Blockchain technologies are increasingly being incorporated into traditional financial systems rather than replacing them, reflecting a broader trend of regulated technological convergence within modern financial markets. Current regulatory and market developments suggest an increasing integration of blockchain-based applications into Traditional Finance (TradFi), rather than replacing it.

Several structural signals indicate that the FinTech sector is entering a more mature phase of development:

- From the standpoint of consumers, behaviour is favouring personalisation, interconnectedness and simplicity in an overall, seamless client relationship with financial services, which lead to the creation of customer-driven digital ecosystems by FinTech firms.
- On a competitive level, FinTechs are increasingly adopting a co-opetition approach to competition (i.e. competition in the marketplace and cooperation through strategic alliances with banks, technology companies, and other financial intermediaries).
- At the same time, firms competing in the FinTech sector are going through continuous product innovation so they can adapt to customer behavioural changes and technological disruptions.
- Technological transformation continues to be, however, further demonstrated through the use of blockchain technology and DeFi solutions.
- From a regulatory perspective, however, increased regulation of the FinTech sector requires that financial institutions and FinTech firms making digital transactions invest in compliance systems, cybersecurity technologies and Regulatory Technology (RegTech) to maintain operational resilience and regulatory compliance.

Developments in the FinTech can be classified into four interconnected macro dimensions. First, there is a technological layer that includes the fast-growing uses of artificial intelligence, blockchain and tokenisation technologies, as well as cloud based and Application Interface (API) infrastructures that create scalable, interoperable, data-driven financial ecosystems. Second, there is a change in the market structure. Embedded finance, open finance ecosystems and platform-based models for providing financial services are causing continuous disruption to traditional methods of financial intermediation [8]. Financial services are now being

embedded into broader digital ecosystems, reducing the difference between financial and non-financial platforms. Thirdly, there has been a shift in the institutional and regulatory dimension of FinTech. The ever-increasing use of Regulatory Technology (RegTech), automated compliance and operational resilience is a direct result of increased regulatory scrutiny and the need to balance innovation with legal/supervisory obligations. The emergence of comprehensive European union regulatory frameworks (such as PSD3, PSR, FiDA, MiCA, CCD2 and AI act) illustrates the shift toward proactive digital finance governance. The need for FinTech firms to achieve profitability and build sustainable business models will remain a major strategic objective as they operate in a more restrictive financial services environment [9]. Lastly, user experience remains a key differentiator for FinTech firms. Real-time payments, hyper-personalised financial services and digital-first interaction models are increasingly shaping consumer expectations and redefining standards of financial service delivery in the digital economy.

1.2. Regulatory technology

As financial regulation becomes more complex, the development of RegTech is accelerating due to increased regulatory scrutiny, particularly in the EU, across AML, KYC, cybersecurity, operational resilience and AI governance [10]. The rise of supervisory scrutiny in these areas has driven FinTech firms and financial institutions to develop technology-driven compliance systems that automate regulatory processes, thereby helping mitigate operational risk. As such, RegTech is becoming a core component of financial services infrastructure and compliance capabilities may function as a barrier to entry in highly regulated market segments. Regulatory requirements are increasingly embedded within digital compliance and governance systems.

Most contemporary RegTech solutions rely heavily on artificial intelligence, machine learning and real-time data analytics to provide automated reporting, transaction monitoring, identity verification and continuous compliance verification. As a result, compliance obligations are being transformed from a static set of legal obligations into a programmable, data-centric operating model, often referred to as compliance as code [11,12]. Within this paradigm, regulation shifts from a post-event, legal supervisory function to one embedded in organisations' digital infrastructure and automated decision-making processes in the present. From a strategic perspective, regulatory capability itself is becoming a source of competitive advantage. As compliance costs and technological requirements rise, regulatory adaptation may function as a barrier to market entry, favouring firms with advanced compliance infrastructures and scalable technological capabilities. In this sense, FinTech regulation increasingly resembles a "red queen" dynamic, whereby regulators, financial institutions and malicious actors continuously co-evolve in response to technological innovation, cybersecurity threats and financial system vulnerabilities (attackers and defenders evolve simultaneously) [13].

1.3. Research gap and contribution

Existing studies on EU FinTech regulation typically focus on individual regulatory initiatives, such as payment services, crypto-assets, artificial intelligence or consumer credit, examined separately. Less attention has been devoted to how these measures collectively reshape the institutional architecture of digital finance in the European union. This article contributes by developing an integrated analytical framework of regulated convergence that explains how multiple EU regulatory initiatives collectively transform FinTech from a disruptive innovation ecosystem into a harmonised and institutionally embedded component of

European financial infrastructure. Using a lifecycle perspective, the article identifies a transition from innovation-led expansion (2015–2021) toward regulatory integration and ecosystem governance (2023–2026).

This research addresses that gap by analysing PSD3, PSR, IPR, FiDA, the AI act, MiCA and CCD2 as interconnected elements of a broader regulatory transformation. It contributes to the concept of regulated convergence, which explains how EU FinTech is evolving from a fragmented, innovation-driven environment into a more integrated system based on interoperability, operational resilience, consumer protection and data governance. By focusing on the interaction between regulatory initiatives rather than their individual provisions, the article provides insights into the emerging governance architecture of European digital finance that extend beyond descriptive policy summaries. Unlike conventional FinTech law reviews that primarily summarise legal provisions or assess individual regulatory instruments, this study adopts a comparative and interdisciplinary perspective that integrates legal analysis with institutional and techno-economic interpretation.

These multiple regulatory initiatives collectively move the FinTech sector from a phase characterised by disruptive innovation, fragmented governance and venture capital driven expansion toward a more integrated model based on interoperability, operational resilience, accountability, data governance and institutional coordination. It provides a conceptual explanation of how European FinTech is evolving from disruptive decentralisation toward regulated convergence within a harmonised digital financial ecosystem.

2. Methodology and Literature

The qualitative interdisciplinary approach used in this study draws upon three research methodologies: doctrinal legal analysis, comparative regulatory analysis and techno-economic interpretation. The main units of analysis are European union regulatory instruments and legislative frameworks that govern digital financial services from 2023 to 2026 including Payment Services Directive & Payment Services Regulation (PSD3, PSR); Instant Payments Regulation (IPR); Financial Data Access Regulation (FiDA); Digital Operational Resilience Act (DORA); Artificial Intelligence Act (AI Act); Markets in Crypto-Assets Regulation (MiCA) and Consumer Credit Directive 2 (CCD2). The research question is:

How is the European union reconfiguring FinTech from a disruptive innovation ecosystem into an institutionalised, compliance-driven financial infrastructure?

The doctrinal examination of the regulatory framework was conducted predominantly through the use of EU legislation (directives, regulations, proposals, etc.), legislative proposals, policy communications, supervisory frameworks and institutional reports prepared by the European commission, European parliament, European Banking Authority (EBA), European Central Bank (ECB) and the International Monetary Fund (IMF) [14]. The analysis assesses how these regulatory initiatives are collectively reshaping the financial market structure and regulatory compliance requirements, the digital financial intermediary function, and the business models of FinTechs across the EU member states.

The analysis of embedded finance includes comparative and conceptual regulation of the open finance ecosystem, AI governance, crypto-asset regulation and Regulatory Technology (RegTech). The analysis of embedded finance is conducted using a lifecycle interpretative framework that helps identify the expansionary phase of FinTech development (2015–2021)

and the subsequent consolidation/regulatory integration phase after 2023, based on the recent introduction and ongoing implementation of regulatory instruments [15].

Therefore, the article employs a qualitative institutional and regulatory analysis rather than a quantitative ex post impact analysis of the previous phase of FinTech development. Additionally, the literature review provides an interdisciplinary academic foundation of financial law, digital economics, innovation studies and FinTech governance. Moreover, the article utilises European union-based policy papers, reports and documents derived from the European Central Bank (ECB), European Banking Authority (EBA), International Monetary Fund (IMF), Bank for International Settlements (BIS) and leading financial analysis and research firms in relation to FinTech. These elements support the overall goal of the above study, which is to relate the emerging EU FinTech regulatory framework to broader theoretical discussions of platform-based economies, financial digitalisation, algorithmic governance and institutional transformation in the current financial services industry. Each regulatory instrument was assessed according to six analytical dimensions: regulatory objective, regulated actors, compliance obligations, enforcement mechanisms, interaction with existing financial law and expected market effects (Table 2).

Table 2: *Methodological table.*

Dimension	Specification
Period covered	2023–2026.
Primary sources	EUR-Lex legislation, commission proposals, EP and council documents.
Secondary sources	Peer-reviewed journals, ECB, EBA, ESMA, BIS, IMF reports.
Inclusion criteria	Regulatory instruments with direct impact on EU digital financial services.
Comparative categories	Objective, actors, obligations, enforcement, implementation timeline, market impact.
Limitations	No ex-post impact evaluation; no quantitative measurement of outcomes.

Source: *Own compilation of the author.*

The qualitative interdisciplinary methodology combines the doctrinal legal analysis, comparative regulatory analysis and techno-economic interpretation. The analysis focuses on PSD3, PSR, IPR, FiDA, DORA, the AI act, MiCA and CCD2 as the principal EU regulatory initiatives shaping digital financial services between 2023 and 2026. The source base includes EU legislation and legislative proposals, policy and supervisory documents issued by the European commission, the European parliament, the EBA, the ECB, the ESMA, the BIS and the IMF, as well as peer-reviewed academic literature. Each regulatory instrument is analysed using a common framework consisting of regulatory objectives, regulated actors, key obligations, enforcement mechanisms, implementation timelines and expected market impacts. The study focuses on regulatory frameworks directly governing FinTech activities. Related initiatives, including GDPR, AML/CFT reforms, eIDAS 2.0, NIS2, the data act and digital euro proposals, are acknowledged where relevant but fall outside the article's primary scope. The objective is not to measure regulatory outcomes empirically but to identify emerging patterns in the institutional development of EU digital finance.

As a qualitative legal-regulatory review, the study does not seek to establish causal relationships between regulatory developments and market outcomes. Rather, it identifies emerging patterns in EU digital finance based on legislative developments, policy documents and supervisory assessments. References to trends such as institutionalisation, increased

compliance requirements, operational resilience and ecosystem integration should therefore be interpreted as analytical propositions derived from the evolving regulatory framework rather than as empirically verified market outcomes.

3. Payment Standards

3.1. Payment services

The third set of regulations in the EU's digital payment system, the Payment Services Directive (PSD3) and the Payment Services Regulation (PSR), reflect an evolution of the rules established under the second set of regulations (PSD2) and will implement additional rules to promote an open banking ecosystem and to create similar rules for providing payment services across all EU member states [16]. Additional objectives of these directives include enhancing consumer protection, increasing competition in the marketplace and supporting innovation through a more secure and unified regulatory framework. A central objective of PSD3 and PSR is to strengthen fraud prevention measures by imposing stricter requirements for information sharing, transaction monitoring, and security protocols. Payment Service Providers (PSPs) may be held liable for losses incurred by their customers when their inadequate fraud prevention processes are a proximate cause of those losses. The rules also enhance consumer rights by improving fee transparency, establishing clear processes for obtaining reimbursement and requiring all PSPs to participate in alternative dispute resolution [17].

The directives also promote a more level playing field between banks and non-bank payment service providers by reducing barriers to entering the open banking space resulting from the current quality and standardisation of Application Programming Interface (API) technology used by these entities. They are expected to facilitate cross-border transactions within the EU single market by simplifying authorisation processes and increasing harmonisation of supervisory requirements across EU member states. Furthermore, the framework emphasises maintaining access to cash, particularly in rural and remote regions, thereby supporting financial inclusion alongside digital transformation.

From a legislative perspective, on 27 November 2025, negotiators from the European parliament and the council of the European union successfully reached an agreement on the relevant provisions of PSD3 and PSR, marking a significant milestone in the legislative process. These two legislative instruments are both expected to start being implemented between the end of the first quarter of 2026 and the beginning of the second quarter of that year [18]. Once implemented, payment institutions, FinTechs and financial intermediaries will be allowed to transition to operate under these new laws for approximately 21 months, giving them sufficient time to upgrade their systems and processes to accommodate the new regulatory requirements.

3.2. Instant payments

The Instant Payments Regulation (IPR) is an important part of modernising the European union's payment infrastructure, as it creates the ability to facilitate an instant credit transfer across all parts of the EU and establishes real-time payments as a standard component of the European financial system, not just as a niche or premium service. In providing traditional credit transfers, Payment Service Providers (PSPs) are also required to offer instant credit transfers as an alternative for their customers [19].

According to one of the main components of this regulation, instant credit transfer charges should not exceed the applicable charge for conventional credit transfers of the same type. This principle aims to increase consumer acceptance of real-time payments and reduce the economic impediments to them. The establishment of mandatory Verification of Payee's (VoP's) services enhances the security of payment transactions. This includes having payment service providers confirm the identity of the person's intended to receive the funds prior to executing the transaction. Notably, this requirement applies to both instant and conventional credit transfers, thereby enhancing fraud prevention and transaction transparency throughout the payments process. Furthermore, PSPs offering instant payment services must also perform ongoing monitoring to determine whether clients or customers have been subjected to targeted financial prohibition measures and/or sanctions regimes. These verification requirements must occur at least once a day, reflecting a growing convergence of the objectives of financial security and anti-money laundering initiatives throughout the European union's payments framework.

The European union's IPR officially became effective on 1 January 2024; however, implementation has progressed throughout 2025 and continues into 2026. European union PSPs were required to have the technical capability to provide instant payment services by 9 January 2025, while the necessary infrastructure for instant payment transmission should be completed by October 2025 [20]. Furthermore, the Verification of Payee (VoP) scheme rulebook also entered into force in October 2025, marking an important milestone in the operational standardisation of instant payment systems across the single market, fostering the free movement of capital.

3.3. Digital operational resilience

The Digital Operational Resilience Act (DORA) is a critical part of the European union's digital finance strategy, providing a uniform basis for managing ICT-related risks across the financial sector. DORA addresses the increasing reliance of financial institutions on digital infrastructure (both cloud-based and traditional), third-party technology providers and interconnected information systems. The regulation became effective in 2025 and covers a wide array of financial services entities, including banks, payment institutions, electronic money institutions, investment firms, traded issuers and many FinTechs.

Under DORA, FinTechs are subject to several requirements concerning ICT governance, incident reporting, operational resilience testing and third-party risk management. All financial services entities must establish internal frameworks to effectively identify, monitor, and mitigate ICT-related risks while ensuring they can continue to operate in the event of a cyber incident or other disruption. One of the key aspects of DORA is its oversight framework for critical ICT third-party service providers; we particularly see this with cloud-computing platforms and technology vendors that are increasingly relied on by financial services.

In relation to the digital operational resilience testing, financial entities, other than microenterprises, must:

- Establish, maintain and review a sound and comprehensive digital operational testing programme equipped with the necessary assessments, tests, methodologies, practices and tools.
- Carry out, at least every three years, threat-level penetration testing based on their risk profile and taking account of operational circumstances, and only use testers that are certified, possess the necessary expertise and suitability and have professional indemnity insurance.

As many FinTech business models are built on outsourced digital infrastructure, DORA also extends the supervisory focus from financial institutions themselves to the broader technological ecosystem in which they operate. This reflects a change from institution specific supervision to ecosystem-based governance of digital finance. From a strategic standpoint, DORA also supports the broader trend of regulatory convergence observed in this article. Operational resilience has shifted from being treated solely as a technical/cybersecurity issue to a core regulatory requirement. As a result of this shift, investments in areas such as cybersecurity, resilience testing, governance systems and Regulatory Technology (RegTech) are becoming increasingly important to FinTech firms' competitive strategy within the European union. DORA will therefore augment PSD3/PSR, FiDA, the AI act and MiCA by providing an operational resiliency layer for the developing European digital finance architecture.

4. Financial Data Access

The Financial Data Access Regulation (FiDA), introduced by the European commission in 2023, is part of the European union's broader strategy to move from open banking to an open finance system. While PSD2 primarily allows customers to share their payment account data, FiDA seeks to extend data sharing beyond payment account information; it will allow them to share information across a broader range of financial services. FiDA is likely to require financial institutions to manage consent, govern their customers' data, protect it from cyber threats and operate their businesses securely, while also addressing how to allocate liability if a customer's data is corrupted or lost [21].

The FiDA regulation aims to establish a standardised and interoperable framework for financial data sharing environment that will support the development of a secure and efficient financial ecosystem. By allowing customers to share their data through a standardised, consent-based data sharing mechanisms, the regulation will support the creation of lower cost, integrated and customised financial products and services. Increased access to customer data is expected to improve credit risk assessments, underwriting methodologies, customer segmentation and the integration of services across the entire financial industry. Companies that provide FinTech services are expected to increase their investments in compliance solutions and technical integration capabilities as they prepare for the implementation of future compliance requirements.

Despite its continuing progress toward final approval, the FiDA remains at the proposal stage but is strategically impactful in forming the European FinTech landscape. The proposal's status was last acknowledged on 31 October, 2025, as it appeared on the consolidated list of pending legislation in the European commission's annex III. Trialogue discussions for this legislation came to a halt in early February 2026, at the time of writing, FiDA remains under legislative consideration and its final implementation timeline remains uncertain. However, both the European and US governments have indicated that they believe the current phase is primarily intended to prepare for the future implementation of a financial inclusion act by many banks and FinTechs expected to be affected, with implementation possible by approximately 2027.

5. Artificial Intelligence

5.1. The usage of AI

The effect of AI on the financial services industry can be viewed through four mutually-reinforcing dimensions:

- Autonomous finance and AI-driven decision-making.
- Algorithmic and machine-learning-based trading systems.
- High-frequency trading and AI-accelerated market dynamics.
- Hyper-personalisation and customer-centric financial services [22].

Autonomous finance refers to the use of AI systems to support or automate financial decision-making. It uses advanced artificial intelligence, such as Large Language Models (LLMs), to help people make financial decisions. Examples of this type of technology include, but are not limited to: real-time data integration; smart contracts and embedded finance functions, which do things like budget without human intervention; aid in making investments with machine learning; provide ways to reduce debt through technology and make sure bills are paid when due on their terms (i.e. by using automatic payment functions). As much as autonomous finance can potentially decrease transaction costs and people's errors in how they act in financial markets, it also creates new risks from our dependence on technology, the risk of systematic errors and the reduction in human involvement in financial decision-making (Table 3).

Table 3: *Potential impact of the adoption of artificial intelligence in algorithmic trading.*

	Negative scenario	Positive scenario
Market liquidity	Market liquidity. AI could "democratise" and expand algorithmic trading activity to a broader set of assets and geographic areas.	AI increases the stability of algorithmic trading under stressed conditions. AI-driven algorithms could operate across a wider set of market conditions, with lower flash-crash risk and reduced liquidity withdrawal under stress.
Leverage	AI-driven strategies boost short-term leverage. As arbitrage opportunities are exploited more efficiently by more advanced algorithms, remaining opportunities might require higher leverage to deliver similar returns.	AI improves the management of leverage and related risks. AI could facilitate more frequent, automated management of leveraged positions with more inputs and mitigate operational lags.
Inter-connectedness	AI increases interconnectedness and extends it to other asset classes, geographic regions, and trading venues in a multi-asset, multi-trading-venue approach. Increased interconnectedness leads to higher correlations between capital market segments, facilitating spillovers and transmission of stress.	- Market access, efficiency and liquidity improve for some market segments, including emerging markets.

Source: Based on IMF (<https://www.imf.org/en/Publications/GFSR>).

The execution process of trading has changed and is now primarily driven by data-driven models and machine learning algorithms that create strategies for executing trades, such as trend following, arbitrage, index balancing, mean reversion, momentum trading, position sizing and portfolio optimisation. In addition, trade executions will, at a minimum, improve when execution-based models, such as VWAP (Volume Weighted Average Price) and TWAP (Time Weighted Average Price) [23], are included in an organisation's operations, as they provide greater liquidity and efficiency in their respective markets.

High Frequency Trading (HFT), which utilises the latest technological innovations based on Artificial Intelligence (AI) and Algorithmic Finance (AF), is considered one of the most complex application areas of AI and AF. In modern day financial markets, speed and latency have become critical competitive advantages for firms that exploit millisecond-level informational asymmetries to execute trades using Latency Arbitrage strategies. HFT is designed to improve liquidity and efficiency in markets; however, it has also been linked to increased volatility, greater systemic interdependence and heightened flash-crash dynamics during market stress. According to Siddharth Vadera, in the modern market, speed is currency. Latency arbitrage shows how milliseconds can make millionaires [24].

AI and the use of advanced data analytics are changing the nature of consumer finance by creating mass customisation of financial products via hyper-personalisation of financial products (i.e. personalised credit, deposit, investment & insurance pricing/offers) and real-time customisation of financial products (i.e., credit, investment, insurance & payment products). Increasingly, financial institutions are using behavioural analytics, predictive modelling, and dynamic pricing systems to deliver financial products, including credit, investment, insurance and payment services, customised to individual users [25]. The AI increasingly plays a role in algorithmic trading and high frequency trading environments for example, machine learning algorithms help to with market making, liquidity provision, execution optimisation and implementing arbitrage strategies. Many argue that AI will increase the efficiency of financial markets; however, AI also raises concerns about market integrity, operational resilience and systemic risk. In the EU, most of these activities are regulated by MiFID II, MiFIR and the market abuse regulation rather than the AI act. Therefore, AI's regulatory status in financial markets is not determined solely by legislation regarding AI; it also falls under a suite of financial supervisory and market conduct rules, as well as algorithmic trading requirements.

5.2. EU AI act

The European union's AI act, set to be implemented in 2024, is the first to provide a comprehensive regulatory framework for AI across digital sectors, including financial services and FinTech. The AI act balances technological innovation with consumer protection, while ensuring transparency, cybersecurity and the protection of fundamental rights; this act will set a global standard for AI governance. The regulation applies a risk-based classification model and assigns AI to three risk categories:

- AI applications and systems that pose unacceptable risk, such as government-run social scoring.
- High-risk applications, such as CV scanning tools.
- Unregulated applications that are not explicitly banned or labelled high-risk. Within the financial sector, high-risk categories include AI systems used for credit scoring,

creditworthiness assessments, insurance underwriting, biometric identification and automated decision-making processes [26].

Within the financial sector, the AI act applies different regulatory requirements depending on the specific use case and risk classification. Under annex III, high-risk AI systems include, among others, systems used for creditworthiness assessment and credit scoring of natural persons, as well as certain insurance-related risk assessment and pricing applications. Biometric identification systems are subject to separate provisions and risk categories. By contrast, fraud detection, customer onboarding, customer profiling and other operational uses of AI are not automatically classified as high-risk and must be assessed according to the specific provisions and scope of the regulation. FinTech firms must evaluate individual AI applications on a case-by-case basis to determine whether high-risk obligations, transparency requirements or other compliance measures apply.

FinTech companies will need to meet numerous significant operational and compliance requirements under the AI act. From 2 August 2026, high-risk obligations will apply to AI systems falling within the categories defined by annex III of the AI act, including certain applications used for creditworthiness assessment, credit scoring, insurance risk assessment and specified biometric uses. All FinTech companies must assess their compliance with these regulatory standards, maintain technical documentation, implement risk-management and human review processes and ensure their data governance processes meet applicable standards to keep their AI systems operational in the EU. A key element of the regulation is the expected transparency and accountability for automated decision-making. Specifically, all financial institutions must demonstrate that their AI systems operate in a manner that minimises discrimination and have a clear ability to explain how an AI decision has been reached if it significantly impacts an individual's access to financial services [27].

The inclusion of accountability and explainability requirements for automated decision-making systems is a significant advancement under the AI act. Financial institutions that utilise AI in credit underwriting or insurance assessment must demonstrate that their automated systems operate transparently, avoid discriminatory outcomes and have sufficient human oversight. Additionally, article 27 of the law requires that the creators or deployers of high-risk systems that employ AI conduct a Fundamental Rights Impact Assessment (FRIA), particularly when AI applications will have a major impact on a person's ability to access basic financial services. The regulation also creates significant enforcement ramifications. Noncompliance with high-risk AI obligations can lead to administrative fines up to €15 million or 3% of the worldwide total revenue of the entity's related business. Violations of prohibited AI uses can lead to fines of up to €35 million or 7% of the entity's total worldwide revenue. Noncompliance will thus lead to severe administrative fines and amplify the role of AI governance as an increasingly critical component of FinTech regulation and operational resiliency within the European union.

6. Markets in Crypto-Assets

The EU's regulation of financial services, known as MiCA or MiCAR (Markets in Crypto-Assets), provides a cohesive framework of legal certainty, market transparency and consumer protection for crypto-assets and Crypto-Asset Service Providers (CASPs) within the rapidly developing digital asset markets [28]. MiCA also provides the EU with a basis to support innovation and financial stability through the regulation of crypto-assets and CASPs. MiCA establishes a common supervisory regime for crypto-assets, thereby eliminating the fragmented national approaches to their regulation under the MSs' regulatory regimes. It

establishes operational, prudential and governance requirements for CASPs, including authorisation and disclosure requirements, risk management and consumer protection requirements.

MiCA is anticipated to create a common regulatory framework for crypto-assets across all EU member states by the end of 2024, with interim transition arrangements for those CASPs that currently operate under national regulatory regimes. For these CASPs, the MiCA provides for a grandfathering period during which their operations will not be required to comply with the new MiCA requirements. CASPs operating in member states continue their operations under transitional authorisation arrangements provided by their MSs' regulations until 1 July 2026. Based on these transitional authorisation arrangements, it is anticipated that the EU crypto-asset market would be governed by a single, much stricter regulatory framework after mid-2026. MiCA is likely to accelerate the institutionalisation and professionalisation of crypto markets within Europe while increasing compliance obligations, supervisory oversight and operational requirements for crypto-asset service providers [29].

7. Consumer Credit Rules

The Consumer Credit Directive 2 (CCD2) modernises the European union's consumer credit framework by expanding regulatory protection to newer digital lending products, particularly small-value loans (under €200) and Buy Now, Pay Later (BNPL) solutions. The purpose of the directive is to enhance consumer protection, improve clarity and support responsible lending in an increasingly digitalised lending market. It enacts stricter requirements for lenders regarding conducting credible creditworthiness reviews of consumers, ensuring fair lending practices and exercising sufficient supervisory discretion over lenders [30].

The CCD2 continues to provide for additional limits on:

- How management fees are calculated and charged to borrowers.
- The maximum amount (if any) of interest that can be charged; if any; and
- The use of balloon payments, by requiring that, instead of having one large payment due in full to satisfy a loan, the amounts paid to satisfy the obligation will be paid equally every month over at least three months from the date of the loan.

These provisions are designed to mitigate the risk of consumer over-indebtedness and improve financial stability in the retail lending environment through rigorous compliance standards and supervisory oversight.

Member states shall have until 20 November 2025 to implement CCD2 into national law and full compliance with CCD2 would be achieved by 20 November 2026. Financial institutions and FinTech lenders across Europe will be required to begin adapting their operational and compliance frameworks to national implementation timelines in 2026. France transposed CCD2 through ordinance No. 2025-880 in September 2025, and Spain is the only member state yet to implement the directive fully. Only four member states (Denmark, Hungary, Italy and Slovakia) have fully notified their transposition measures [31]. However, Spain has introduced a draft consumer credit bill for public consultation as of January 2026 [32]. In addition, CCD2 aligns with the European union's overall regulatory strategy to extend existing consumer protection principles to digital finance ecosystems and to impose greater compliance and responsible lending requirements on FinTechs and consumer credit providers [33].

8. Conclusion

Current regulatory developments suggest a major transition within the European FinTech sector from a largely disruptive, venture-capital-funded model to a more developed, compliant and institutionalised financial market. The examined regulatory developments suggest that European FinTech may be evolving from a predominantly innovation driven environment toward a more institutionally integrated framework characterised by interoperability, operational resilience, consumer protection and data governance. While emerging evidence from regulatory and supervisory reports points to increasing emphasis on compliance, resilience and ecosystem integration, the long-term market effects of these developments remain subject to future empirical verification. Consequently, the concept of regulated convergence should be understood as an analytical interpretation of current regulatory trends rather than a definitive prediction of market outcomes.

As the FinTech industry developed from 2015 to 2021, it was characterised mainly by rapid growth, technology experimentation, and market disruption. However, the period after 2023 increasingly reflects regulatory convergence, operational resilience and profit structures, as well as deeper integration with traditional financial institutions. The comparative analysis reveals that the emerging EU FinTech framework operates across five interconnected governance dimensions: payment standards and market-access regulation (MiCA, PSD3/PSR), conduct regulation (CCD2, PSD3/PSR), data governance (FiDA), operational resilience (DORA) and technology-risk regulation (AI act). Collectively, these instruments illustrate a broader process of regulated convergence, whereby previously separate areas of financial regulation are increasingly integrated into a common governance architecture for digital finance. The regulatory frameworks show how the EU is developing a comprehensive governance framework for digital finance. Rather than regulating solely on a technology-by-technology or sector-by-sector basis, the EU's approach is focused on creating interoperable, harmonised and technology-integrated financial systems [34]. These include everything from payment processing and accessing financial data to using artificial intelligence, cryptocurrency and lending digitally.

Many long-term trends are affected by this transition. Financial services are evolving into data-driven, platform-based infrastructures through embedded finance, open finance ecosystems, artificial intelligence, blockchain integration, and Regulatory Technology (RegTech). In addition, compliance is evolving into a strategic systems capability through automated monitoring, AI-assisted supervision and "compliance as code" solutions. This means that regulatory adaptation is no longer simply a legal requirement; rather, it is becoming a source of competitive advantage and institutional good standing within digital finance.

Recent industry and supervisory reports indicate declining venture capital investment volumes compared with the peak years of 2020–2021, accompanied by increasing market consolidation, greater emphasis on profitability and growing investment in compliance and operational resilience capabilities. While these developments do not establish a direct causal relationship between regulation and market outcomes, they provide contextual evidence consistent with the broader trend of regulated convergence identified in this study.

The evolution of European FinTech indicates that future developments in digital finances will be determined less by disruptive innovation alone than by the institutional integration of technology into a highly interoperable financial ecosystem. The European union is also increasingly emphasising regulation as the foundational architecture for digital finance. In the

emerging environment, competitive advantage is likely to depend increasingly not only on technological competencies but on the ability to combine these capabilities with compliance, operational resilience and ecosystem interoperability in a monetary system based on ever-increasing amounts of data (Table 4).

Table 4: *Selected indicators of structural change in the European FinTech sector.*

Indicator	2020–2021	2023–2025	Regulatory interpretation
Venture capital funding	Record investment levels supported by low interest rates and growth-oriented strategies.	Lower investment volumes and greater investor selectivity.	Shift from growth-at-all-costs toward sustainable business models.
Mergers and Acquisitions (M&A)	Secondary strategic importance.	Increasing consolidation activity and strategic acquisitions.	Market maturation and institutional integration.
Bank–FinTech relationships	Predominantly competitive.	Increasing partnerships and Banking-as-a-Service arrangements.	Growth of ecosystem-based business models.
Crypto-asset markets	Speculative growth and fragmented regulation.	Expansion of regulated crypto-asset services under MiCA.	Institutionalisation of digital assets.
Compliance and RegTech investment	Compliance primarily viewed as a cost function.	Increasing investment in automated compliance and operational resilience.	Regulation becoming a strategic capability.
Supervisory focus	Innovation promotion and market entry.	Operational resilience, consumer protection, AI governance, and data sharing.	Emergence of integrated digital finance governance.
Open banking / open finance	PSD2-driven payment account access.	Expansion toward cross-sector financial data access through FiDA.	Data becoming a strategic financial asset.

Source: *Compiled by the author based on ECB, EBA, BIS, IMF, KPMG pulse of FinTech and deal room reports (2023–2025).*

9. Declaration

9.1. Data and source availability

This study is based exclusively on publicly available legal, regulatory, policy and academic sources. The primary materials analysed include European Union regulations, directives, legislative proposals, institutional reports, and peer-reviewed literature cited in the references. No proprietary datasets, human subjects, or confidential information were used in the preparation of this article.

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EU Legislation

AI act: Regulation (EU) 2024/1689 of the European parliament and of the council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending regulations (EC) no 300/2008, (EU) no 167/2013, (EU) no 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (artificial intelligence act) (text with EEA relevance).

CCD2: Directive (EU) 2023/2225 of the European parliament and of the council of 18 October 2023 on credit agreements for consumers and repealing directive 2008/48/EC.

DORA: Regulation (EU) 2022/2554 of the European parliament and of the council of 14 December 2022 on digital operational resilience for the financial sector and amending regulations (EC) no 1060/2009, (EU) no 648/2012, (EU) no 600/2014, (EU) no 909/2014 and (EU) 2016/1011 (text with EEA relevance).

FiDA: COM (2023) 360 final proposal for a regulation of the European parliament and of the council on a framework for financial data access and amending regulations (EU) no 1093/2010, (EU) no 1094/2010, (EU) no 1095/2010 and (EU) 2022/2554.

IPR: Regulation (EU) 2024/886 of the European parliament and of the council of 13 March 2024 amending regulations (EU) No 260/2012 and (EU) 2021/1230 and directives 98/26/EC and (EU) 2015/2366 as regards instant credit transfers in euro (text with EEA relevance).

MICA: Regulation (EU) 2023/1114 of the European parliament and of the council of 31 May 2023 on markets in crypto-assets, and amending regulations (EU) no 1093/2010 and (EU) no 1095/2010 and directives 2013/36/EU and (EU) 2019/1937 (text with EEA relevance).

PSD3: COM (2023) 366 (final) proposal for a directive of the European parliament and of the council on payment services and electronic money services in the internal market amending directive 98/26/EC and repealing directives 2015/2366/EU and 2009/110/EC.

PSR: Payment services regulation COM (2023) 367 (final) proposal for a regulation of the European parliament and of the council on payment services in the internal market and amending regulation (EU) no 1093/2010.

Appendix

Table 1: *Comparative framework of EU FinTech regulation.*

Regulation full name	Main objective	Core regulatory focus	Key areas affected	Main obligations for FinTechs / financial institutions	Degree of harmonisation	Enforcement intensity	Strategic impact on FinTech sector	Expected / key timeline
AI Act (Artificial Intelligence Act)	Establish a harmonised EU framework for trustworthy and risk-based AI governance	Risk classification of AI systems (unacceptable, high-risk, limited-risk)	Credit scoring, insurance underwriting, biometric identification, fraud detection, onboarding	Conformity assessments, technical documentation, risk management, human oversight, transparency, explainability Fair lending practices, stricter affordability checks, fee and interest limitations, repayment structure requirements ICT risk governance, incident reporting, digital operational resilience testing, third-party risk management, business continuity planning, cybersecurity monitoring	High	High	AI governance becomes a core compliance and operational requirement; increased compliance costs but higher trust and institutionalisation	Core FinTech-related obligations apply from 2 August 2026
CCD2 (Consumer Credit Directive 2)	Modernise consumer credit regulation and strengthen consumer protection	Regulation of digital lending and BNPL products	Consumer lending, BNPL, micro-loans, creditworthiness assessments	ICT risk governance, incident reporting, digital operational resilience testing, third-party risk management, business continuity planning, cybersecurity monitoring	Medium	Medium-High	Greater consumer protection and stricter supervision increase barriers to entry for digital lenders Operational resilience becomes a core regulatory and competitive requirement; increases compliance obligations, strengthening trust, stability and resilience of digital financial services	National transposition by 20 November 2025; full compliance by 20 November 2026
DORA (Digital Operational Resilience Act)	Establish a harmonised framework for operational resilience across the EU financial sector	ICT risk management, cybersecurity, operational resilience and third-party ICT oversight	Cybersecurity, cloud services, ICT infrastructure, digital operations, third-party technology providers	Consent management, data governance, cybersecurity, interoperability, liability allocation	High	High	Data becomes a strategic competitive asset; supports hyper-personalised finance and ecosystem integration	Entered into application on 17 January 2025 Proposal stage; possible implementation around 2027
FiDA (Financial Data Access Regulation)	Expand open banking toward open finance	Consent-based cross-sector financial data sharing	Banking, investments, insurance, pensions, credit data		High (proposed)	Medium		

IPR (Instant Payments Regulation)	Make instant payments universally available across the EU	Real-time payment infrastructure and payment security	Instant credit transfers, sanctions screening, Verification of Payee (VoP)	Mandatory instant payment capability, equal pricing with standard transfers, payee verification, sanctions check Authorisation requirement s, prudential standards, disclosure obligations, consumer protection, governance requirement s Enhanced fraud prevention, improved customer rights, stronger API standards, dispute resolution obligations Uniform compliance standards, simplified authorisation, stronger transparency and security obligations	High	Medium	Accelerates real-time digital payments and strengthens payment system integration	Receiving capability mandator y from 9 January 2025; sending capability from Oct 2025
MiCA (Markets in Crypto-Assets Regulation)	Create a unified EU framework for crypto-assets and CASPs	Regulation of crypto-assets and crypto service providers	Stablecoins, crypto exchanges, custody, token issuance, digital assets		High	High	Institutionalises crypto markets and integrates digital assets into regulated finance	Entered into force in 2024; transition period until 1 July 2026
PSD3 (Third Payment Services Directive)	Modernise EU payment services and strengthen open banking	Consumer protection, fraud prevention, payment harmonisation	Payment services, open banking APIs, fraud monitoring		High	Medium-High	Promotes competition while increasing operational and compliance expectations	Political agreement reached 27 November 2025; expected entry into force in 2026
PSR (Payment Services Regulation)	Harmonise payment service rules across the EU single market	Directly applicable payment services regulation	Payment institutions, cross-border payments, open banking		High	Medium-High	Reduces regulatory fragmentation and deepens EU payment market integration	Expected entry into force alongside PSD3 in 2026

Source: Own compilation of the author, the timeline based on official EU communication.